of 1 to 3 units (HR, 1.24 (95% CI, 1.01 to 1.53); $P$ <0.001), and RBC transfusion >3 units (HR, 1.96 (95% CI, 1.45 to 2.66); $P$ <0.001). In an adjusted model for age, EuroSCORE, type of surgical procedure, LVEF and cardiopulmonary bypass time, the exposure to RBC transfusion was associated with an elevated LOS.

**Conclusion** Blood transfusion is an independent risk factor for prolonged hospital LOS after cardiac surgery. This finding can support the development of blood conservation strategies in order to avoid deleterious outcomes of blood exposure.

**Reference**

1. Hajjar LA, Vincent JL, Galas FR, *et al.*: Transfusion requirements after cardiac surgery: the TRACS randomized controlled trial. JAMA 2010, **304:**1559-1567.

## P448

### Transfusion of blood stored for longer periods of time does not alter the reactive hyperemia index in healthy volunteers

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**Introduction** The purpose of this study is to investigate the effects of transfusing human packed red blood cells (PRBC) after prolonged storage, as compared to short storage. Retrospective data suggest that transfusion of PRBC stored for over 2 weeks is associated with increased mortality and morbidity. During storage, PRBC progressively release hemoglobin, which avidly binds nitric oxide (NO). We hypothesized that the NO-mediated hyperemic response following ischemia would be reduced after transfusion of PRBC stored for 40 days.

**Methods** We conducted a cross-over randomized interventional study, enrolling 10 healthy adults. Nine volunteers completed the study; one volunteer could not complete the protocol because of anemia. Each volunteer received 1 unit of 40-day and 1 unit of 3-day stored autologous leukoreduced PRBC, on different study days according to a randomization scheme. Blood withdrawal and reactive hyperemia index (RHI) measurements were performed before and 10 minutes, 1 hour, 2 hours, and 4 hours after transfusion.

**Results** The change of RHI after transfusion of 40-day stored PRBC did not differ as compared to 3-day stored PRBC ($P$ = 0.67). Plasma hemoglobin and bilirubin levels were higher after transfusion of 40-day than after 3-day stored PRBC ($P$ = 0.02 and 0.001, respectively). Plasma levels of potassium, LDH, haptoglobin, cytokines, as well as blood pressure, did not differ between the two transfusions and remained within the normal range. Plasma nitrite concentrations increased after transfusion of 40-day stored PRBC, but not after transfusion of 3-day stored PRBC ($P$ = 0.01).

**Conclusion** Transfusion of 1 unit of autologous PRBC stored for longer periods of time is associated with increased hemolysis, an unchanged RHI and increased levels of plasma nitrite in healthy volunteers.

## P449

### Liberal use of platelet transfusions in the acute phase of trauma resuscitation: a systematic review

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**Introduction** With the recognition of early trauma coagulopathy, trauma resuscitation has recently shifted towards early and aggressive transfusion of platelets (PLTs). However, the clinical benefits of this strategy remain controversial. This systematic review examined the impact of an aggressive approach (higher PLT:RBC ratios) compared to restrictive PLT transfusions (lower PLT:RBC ratios) in the acute phase of trauma resuscitation.

**Methods** We systematically searched Medline, Embase, Web of Science, Biosis, Cochrane Central and Scopus to identify relevant randomized controlled trials (RCTs) and observational studies comparing the effect of two or more different PLT:RBC ratios in trauma resuscitation. We excluded studies using whole blood or systematically addressing the use of hemostatic products. Two independent reviewers selected the studies, extracted data using a standardized form, and assessed the risk of bias using the Newcastle–Ottawa scale and a checklist of key methodological elements (for example, use of massive transfusion protocol, survival bias). Disagreements were solved by consensus or a third party. The primary outcome was mortality. Secondary outcomes were multiple organ failure (MOF), lung injury and sepsis. A meta-analysis using random effects models was planned.

**Results** From 6,123 citations, seven observational studies were included ($n$ = 4,230 patients). No RCT was identified. All studies were considered to be at low risk of bias and addressed confoundings through multivariate regression or propensity scores. Four studies ($n$ = 1,978) reported a decrease in mortality with higher PLT:RBC ratios in patients requiring massive transfusion and one study observed no mortality difference ($n$ = 1,181) in nonmassively transfused patients. Two studies reported on the implementation of a massive transfusion protocol with higher PLT:RBC ratios; only one revealed a survival benefit ($n$ = 211). Of the three studies accounting for survival bias, two demonstrated a survival benefit ($n$ = 1,300). Among two studies reporting on the secondary outcomes ($n$ = 854), one observed an increase in MOF with higher PLT:RBC ratios. Clinical heterogeneity between studies and methodological limitations precluded the use of a meta-analysis.

**Conclusion** There is insufficient evidence to strongly support the use of a specific PLT:RBC ratio for acute trauma resuscitation, especially considering survival bias and nonmassively transfused patients. RCTs examining both safety and efficacy of liberal PLT transfusions are warranted.

## P450

### Impact on early trauma mortality of the adoption of the Updated European Guidelines on the management of bleeding

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**Introduction** Post-traumatic bleeding is the leading cause of potentially preventable death among trauma patients. The Updated European Guidelines (UEG), published at the beginning of 2010, were aimed to provide an evidence-based multidisciplinary approach to improve the management of the critically injured bleeding trauma patients. The aim of this study is to evaluate the impact of the implementation of UEG recommendations on early hospital mortality for severe trauma in a high-flow trauma center.

**Methods** S. Camillo Hospital is a level 1 trauma center based in downtown Rome, with a catchment population of 2.5 million people. UEG recommendations were formally adopted and implemented since 1 April 2010. The pre-existing hospital guidelines were modified as follows: immediate pelvic ring closure for all unstable patients with a suspected pelvic fracture; early administration of plasma with a higher rate of plasma/blood units; early use of thromboelastometry to monitor bleeding patients; and early use of antifibrinolitics for all bleeding patients. Data on trauma admissions and early hospital (6 hours) mortality before (2009) and after the adoption of the UEG were collected using the hospital registry, and were subsequently analysed.

**Results** A total of 1,617 patients met the criteria for full trauma team activation (551 in 2009, 528 in 2010 and 538 during the first 11 months of 2011). There were no differences for gender, age, mechanism of injury and average ISS. In 2009 21 patients died within the first 6 hours versus 17 in 2010 and 12 in 2011; $P$ = 0.3, $P$ for trend = 0.1 Hemorrhage was the most important cause of death within this time-span. All early trauma deaths occurred in the operating room or in the emergency room during the initial stabilization.

**Conclusion** This is a retrospective cohort study based on the data of the S. Camillo Hospital registry and the emergency department electronic shift. With the limitations of all retrospective studies, our data suggest that the implementation of the European Guidelines recommendations might contribute to a relevant reduction in early trauma mortality.

**Reference**

1. Rossaint *et al.*: *Crit Care* 2010, **14:**R52.